

## PATENT ABSTRACTS OF JAPAN

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(54) LUBRICANT OIL COMPOSITION FOR DIESEL ENGINE WITH DEVICE FOR REMOVING DIESEL FINE PARTICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a lubricant oil composition for a diesel engine with a DPF(diesel particulate filter) capable of reducing clogging of the filter of the DPF by an ash component, capable of improving the combustibility of PM (particulate matter) caught by the filter of the DPF, capable of stably burning the PM at a low temperature, capable of heightening the removing efficiency thereof, and capable of elongating the life of the DPF.

SOLUTION: This lubricant oil composition for the diesel oil engine with the DPF contains  $\leq 1.0$  wt.% sulfuric acid ash component, and has  $\leq 0.3$  wt.% sulfur content and  $\geq 100$  ppm molybdenum content.

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**CLAIMS**

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[Claim(s)]

[Claim 1] A lubricating oil composition for diesel power plants with a diesel particulate filter in which sulfuric acid ash is characterized by sulfur content being [ 0.3 or less % of the weight and molybdenum content ] not less than 100 ppm 1.0 or less % of the weight.

[Claim 2] The lubricating oil composition according to claim 1 which contains an oil-soluble molybdenum compound as a source of molybdenum.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Art in which an invention belongs] this invention -- the lubricating oil composition for diesel power plants with a diesel particulate filter (it outlines a diesel particulate filter and the following "DPF") -- in more detail, the particle-like substance (a particulate matter) which ash plugging in the filter of DPF might be decreased, and was caught with the filter of DPF. It outlines the following "PM". It is related with the lubricating oil composition for diesel power plants with DPF which raises flammability, can be stabilized, can burn this PM at low temperature, and can raise the removal efficiency, and can attain reinforcement of DPF.

[0002]

[Description of the Prior Art] There is a merit that a diesel-power-plant vehicle has good gas mileage compared with a gasoline engine vehicle, it is effective in reduction of carbon dioxide, and also the gas oil used as fuel oil is low-cost compared with gasoline. However, PM contained in the combustion gas discharged from a diesel rolling stock is greatly taken up on the problem of environmental pollution in recent years. This PM is a fine cinder of fuel oil, such as soot, and if it goes into a human body, having an adverse effect on a respiratory system is known. Therefore, reduction of PM in emission gas has been the biggest SUBJECT of the diesel rolling stock. Therefore, in our country, by the new system which will aim at achievement in 2005. A possibility of considering imposing a duty of wearing of DPF upon the diesel rolling stock which each maker company has to reduce PM emission to 1/3 of the present regulation, and will run a metropolitan area around 2003 in Tokyo, and spreading in other self-governing bodies is large.

[0003] From such a situation, it is efficient and development of practical DPF is performed positively, DPF of several sorts of forms, (1) mutual regenerative system DPF and the continuously regenerating DPF by a (2) NO<sub>2</sub> oxidation method, the continuously regenerating DPF by (3) catalyst oxidation method, (4) intermittent regenerative system DPF, etc. are specifically proposed now. Mutual regenerative system DPF of the above (1) is a thing of a switching system which performs catching and reproduction by turns using two filter units which face across both sides of a silicon carbide fiber nonwoven fabric at a wire gauze-like heater and a protection wire gauze. Although it can respond also to the high present gas oil of sulfur content, in order to burn PM, a high current is required for this DPF, and it needs loading of a large capacity generator for exclusive use, and also it has problems, like there is a possibility that a filter may be damaged by rapid combustion.

[0004] The continuously regenerating DPF by the NO<sub>2</sub> oxidation method of (2), According to the oxidation catalyst provided in the upstream using the porosity ceramics which consist of cordierite of wall flow honeycomb structure as a filter. It is a continuous reproduction type device which burns PM which oxidized NO<sub>x</sub> to NO<sub>2</sub> and was caught by the filter at low temperature using the strong oxidizing power of this NO<sub>2</sub>. However, in this method, in order for the activity of this oxidation catalyst to deteriorate and not to fully exhibit a function by the sulfur content in exhaust gas, it is necessary to reduce the sulfur content in fuel oil, and there is a problem that it can be hard to apply in the present gas oil. The continuously regenerating DPF

by the catalyst oxidation method of (3), It is a continuous reproduction type device which burns PM which was not required for heating apparatus, such as a heater, and was caught by this filter only in the operation of a metal catalyst using the porous ceramic filter which consists of cordierite of the wall flow honeycomb structure which coated two kinds of metal catalysts. In this method, since this metal catalyst cannot be influenced comparatively easily by the sulfur content in exhaust gas, it is applicable to the present gas oil, but it is easy to be influenced by Lynn, and high performance is demonstrated, so that there is little sulfur content. Application is difficult for the vehicles and passenger car in more than the rate of a constant ratio the run from which an exhaust-gas temperature will be not less than about 300 \*\* runs [ passenger car ] for a long time at a low speed since it is required. The porous ceramic filter which consists of silicon carbide of wall flow honeycomb structure is used for intermittent regenerative system DPF of (4), It is a method which catches PM, injects fuel at the time of reproduction, raises emission temperature, oxidizes hydrocarbon and carbon monoxide according to an oxidation catalyst, raises temperature further, and burns PM. In this method, a cerium compound is added in fuel oil and PM yield is reduced. Although this method is applicable to the present gas oil, the power supply equipment for reproduction is required, and after-combustion cerium oxide of PM remains, it deposits on a filter, and there is a problem of reducing the life of DPF.

[0005] Thus, each DPF to which the present development is advanced has merits and demerits, and may not necessarily be satisfied fully. It is important to demonstrate the function of DPF effectively and to attain the reinforcement industrially, for that purpose, PM is burned as much as possible at low temperature, and it is important to reduce plugging of a filter as much as possible. Since back pressure will rise if a filter is got blocked, the efficiency of a diesel engine is reduced. Combustion \*\*\*\*\* of PM and plugging for lubricous oil ash are one of plugging of this filter.

[0006]

[Problem(s) to be Solved by the Invention] This invention may decrease ash plugging in the filter of DPF under such a situation, and. It aims at providing the lubricating oil composition for diesel power plants with DPF which raises the flammability of PM caught with the filter of DPF, can be stabilized, can burn this PM at low temperature, and can raise the removal efficiency, and can attain reinforcement of DPF.

[0007]

[Means for Solving the Problem] A result of having repeated research wholeheartedly this invention person developing a lubricating oil composition for diesel power plants with DPF which has the aforementioned desirable character, A lubricating oil composition which sulfuric acid ash and sulfur content are below a certain value, respectively, and is more than a value with molybdenum content found out that the purpose might be suited. This invention is completed based on this knowledge. That is, sulfuric acid ash provides a lubricating oil composition for diesel power plants with DPF in which sulfur content is characterized by 0.3 or less % of the weight and molybdenum content being not less than 100 ppm 1.0 or less % of the weight.

[0008]

[Embodiment of the Invention] The lubricating oil composition for diesel power plants with DPF of this invention ("the lubricating oil composition of this invention" may be called hereafter.) is used for the diesel power plant equipped with DPF as a lubricating oil, and mineral oil and synthetic oil are usually used as the base oil. Although there is no restriction in particular about the kind of this mineral oil and synthetic oil, and others, what usually has the kinetic viscosity at 100 \*\* in the range of 1.5-30 mm<sup>2</sup>/s is used. Here, as mineral oil, paraffin-base system mineral oil, Motoi Nakama system mineral oil, or naphthene basis system mineral oil obtained by the usual purification methods, such as solvent refining and hydrorefining, is mentioned, for example. As synthetic oil, they are polybutene and polyolefine, for example. [Alpha olefin (\*\*) polymer] Various kinds of ester (for example, a polyol ester, dibasic acid EESUTERU, phosphoric ester, etc.), various kinds of ether (for example, polyphenyl ether), silicone oil, alkylbenzene, alkyl naphthalene, etc. are mentioned.

[0009] In this invention, as base oil, one sort of above-mentioned mineral oil may be used, and it

may use combining two or more sorts. The above-mentioned synthetic oil may be used, and two or more sorts may be combined and it may use. It may use combining more than a mineral oil kind and more than a synthetic oil kind. In the lubricating oil composition of this invention, sulfuric acid ash needs to be 1.0 or less % of the weight. This sulfuric acid ash adds sulfuric acid to the carbonization residue which burned the sample and was produced, is heated, and means the ash made into the constant mass, and it is used in order to usually know the quantity of the profile of the metal system additive agent in a lubricating oil composition. If this sulfuric acid ash content exceeds 1.0 % of the weight, there will be many ash contents deposited on the filter of DPF, and they will cause ash plugging of this filter, and the life of DPF will become short. The inflammable improved effect of PM by the below-mentioned molybdenum compound becomes is hard to be demonstrated. As for these points to this sulfuric acid ash content, 0.9 or less % of the weight is preferred. Sulfur content needs to be 0.3 or less % of the weight. If this sulfur content exceeds 0.3 % of the weight, when sulfur uses the metal system catalyst used as catalyst poison for DPF, the activity deterioration of this catalyst arises and the function of DPF becomes is fully hard to be exhibited. As for this point to sulfur content, 0.25 or less % of the weight is preferred.

[0010]Molybdenum content needs to be not less than 100 ppm. This molybdenum serves as a molybdenum oxide and a multiple oxide with the element of molybdenum and others, and is mixed into PM caught with the filter of DPF. As a result, it serves to raise the flammability of this PM, to reduce combustion temperature by about 40-50 \*\*, and to make the life of DPF extend. This operation is demonstrated stably, without being influenced by other ingredients in emission gas, for example, a sulfur compound, and phosphorus compounds. At less than 100 ppm, the above-mentioned operation is not fully demonstrated for molybdenum content, and the purpose of this invention cannot be attained. As for especially molybdenum content, not less than 300 ppm is preferred. The maximum of molybdenum content is restricted by regulation of the above-mentioned sulfuric acid ash content. Although it may distribute or dissolve in the lubricating oil composition of this invention, what is necessary is not to just be restricted in particular as a molybdenum compound used as this molybdenum source but and both inorganic matter and an organic molybdenum compound can be used, the oil-soluble thing to dissolve in this lubricating oil composition is preferred. As an oil-soluble molybdenum compound, for example An alkyl-phosphoric-acid molybdenum salt, Alkylamine salts, such as a molybdenum salt of organic acid, such as a carboxylic acid molybdenum salt, and also molybdic acid, molybdophosphoric acid, cay molybdic acid, thiocarbamate (MoDTC), a thiophosphoric acid salt (MoDTP) of molybdenum, etc. are mentioned. To use MoDTC and MoDTP, it is required to fill restriction of the above-mentioned sulfur content. What serves as MoO<sub>3</sub> or molybdophosphoric acid as a combustion retained material is preferred.

[0011]The lubricating oil composition of this invention can be made to contain the various additive agents commonly used conventionally by the lubricating oil for diesel power plants. As this additive agent, a metal system cleaning agent, non-ash powder medicine, an abrasion proof agent, an antioxidant, a viscosity index improver, pour point depressant, a rust-proofer, metal corrosion inhibitor, a defoaming agent, a surface-active agent, etc. are mentioned, for example. Here, Ca-sulfonate, Ca-salicylate, Ca-FINETO, Mg-sulfonate, Mg-salicylate, etc. are mentioned as a metal system cleaning agent. The content of these metal system cleaning agents is restricted so that the above-mentioned sulfuric acid ash content may not exceed 1.0 % of the weight. When using sulfonate, it is further restricted so that sulfur content may not exceed 3 % of the weight. As non-ash powder medicine, boron system imide, screwimide, etc. are usually used, and the thing of a zinc thiophosphorate (ZnDTP) system or sulfur systems, etc. are mentioned as an abrasion proof agent, for example. To use these sulfur content abrasion proof agents, it is required to fulfill the conditions of the above-mentioned sulfur content. To use the thing of a zinc thiophosphorate system, it is required to fulfill the conditions of a sulfuric acid ash content further.

[0012]

[Example]Next, although an example explains this invention in more detail, this invention is not

limited at all by these examples.

It is carbon black as reference example PM. These 100 weight sections are received using ["MA100" by Mitsubishi Chemical]. The powder of the molybdenum compound and other metallic compounds which are shown in the 1st table as a combustion retained material was mixed at a rate of ten weight sections, and the combustion temperature of the mixture was measured among the air by DT-TGA (differential heat-thermogravimetric analysis) on condition of 10 \*\* the heating rate for /. The combustion temperature of only carbon black was measured similarly. A result is shown in the 1st table.

[0013]

[Table 1]

第 1 表

	混合した燃焼残分の種類	燃焼温度 (℃)
モリブデン 化合物	MoO <sub>3</sub>	587
	リンモリブデン酸	587
他の金属 化合物	燃焼残分なし	640
	CaO	653
	MgO	638
	CaCO <sub>3</sub>	640
	ZnSO <sub>4</sub>	656
	WO <sub>3</sub>	642
	SiO <sub>2</sub>	647
	SnO <sub>2</sub>	632
	ピロリン酸亜鉛	640

[0014]When a molybdenum compound exists so that clearly from the 1st table, it turns out that the combustion temperature of PM is lowered.

The lubricating oil composition of the presentation shown in Examples 1-4 and the comparative example 1 = the 7 2nd table was prepared, in accordance with the following method, ash was made to generate, the ash was mixed, and combustion temperature was measured like the reference example. The result is shown in the 2nd table.

A <generation of ash> lubricating oil is put into a crucible, and the temperature more than the flash point is heated and lit. It cooled radiationally and prepared, after putting that the lit charcoal was burned out into waiting and an every crucible [ 500 \*\* ] furnace for 3 hours and heat-treating it.

[0015]

[Table 2]

第2表-1

			実施例				比較例	
			1	2	3	4	1	2
組成 (重量部)	鉱油		85	85.4	85.5	85.2	86	83
	金属系 清浄剤	300TBN Ca-スルホネート	—	1.6	—	—	—	0.8
		30TBN Ca-スルホネート	—	—	—	—	—	5.2
		300TBN Ca-フィネート	—	—	—	0.3	—	—
		170TBN Ca-サリレート	3	—	—	2.5	3	—
		400TBN Mg-スルホネート	—	—	1.5	—	—	—
	無灰分	ビスイミド	3	4	4	3	3	3
	散剤	ホウ素系イミド	1	1	1	1	1	1
	ZnDTP		1	1	1	1	1	1
	MoDTC		1	1	1	1	—	—
	粘度指数向上剤O.C.P		6	6	6	6	6	6
性状	硫酸灰分量 (重量%)		0.92	0.91	0.90	0.89	0.91	0.9
	硫黄分含有量 (重量%)		0.21	0.23	0.25	0.25	0.17	0.45
	Mo含有量 (ppm)		400	400	400	400	—	—
PM燃焼温度 (℃)			605	610	610	595	640	645

[0016]

[Table 3]

第2表-2

			比較例				
			3	4	5	6	7
組成 (重量部)	鉱油		84.9	87.2	87	85	84
	金属系 清浄剤	300TBN Ca-スルホネート	2.1	0.8	—	—	—
		30TBN Ca-スルホネート	—	—	—	—	—
		300TBN Ca-フィネート	—	1	—	—	2
		170TBN Ca-サリレート	—	—	—	4	3
		400TBN Mg-スルホネート	—	—	2	—	—
	無灰分	ビスイミド	4	3	3	3	3
	散剤	ホウ素系イミド	1	1	1	1	1
	ZnDTP		1	1	1	1	1
	MoDTC		1	—	—	—	—
	粘度指数向上剤OCP		6	6	6	6	6
性状	硫酸灰分量 (重量%)		1.12	0.91	1.11	1.12	1.13
	硫黄分含有量 (重量%)		0.23	0.28	0.26	0.22	0.26
	Mo含有量 (ppm)		400	—	—	—	—
PM燃焼温度 (℃)			640	650	635	640	640

[0017][Note]

TBN: Total-basicty viscosity index improver; OCP (olefin copolymer)

[0018]As shown in the 2nd table, the thing of an example has the low combustion temperature of PM about 40-50 \*\* compared with the thing of a comparative example.

[0019]

[Effect of the Invention]The lubricating oil composition for diesel power plants with DPF of this invention, May decrease ash plugging in the filter of DPF, and the flammability of PM caught with the filter of DPF. It is made to improve, without being influenced by the sulfur compound in

emission gas, or phosphorus compounds, and at low temperature, it can be stabilized, this PM can be burned, and the removal efficiency can be raised, and reinforcement of DPF can be attained.

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[Translation done.]